Appendix A
Environmental Assessment

Abstract

The U.S. Fish and Wildlife Service is proposing to implement a Comprehensive Conservation Plan (CCP) for the DeSoto National Wildlife Refuge (Refuge) in Harrison and Pottawattamie Counties, Iowa, and Washington County, Nebraska. This plan will specify a management direction for DeSoto National Wildlife Refuge for the next 15 years, as described in detail through a set of goals, objectives, and strategies. This Environmental Assessment (EA) considers the biological, environmental and socioeconomic effects that implementing the CCP (the preferred alternative) and three other management alternatives will have on the most significant issues and concerns identified during the planning process.

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Chapter 1
Purpose and Need for the Proposed Action

Purpose and Need for Action

The purpose of the proposed action is to specify a management direction for DeSoto National Wildlife Refuge for the next 15 years. This management direction will be described in detail through a set of goals, objectives, and strategies in a Comprehensive Conservation Plan.

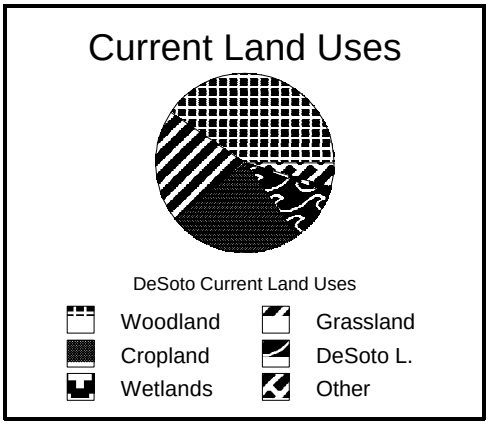
The action is needed to address current management issues and to satisfy the legislative mandates of the National Wildlife System Improvement Act of 1997, which requires the preparation of a Comprehensive Conservation Plan for all national wildlife refuges.

We prepared this Environmental Assessment (EA) using guidelines of the National Environmental Policy Act of 1969. The Act requires us to examine the effects of proposed actions on the natural and human environment. In the following sections we describe four alternatives for future Refuge management, the environmental consequences of each alternative, and our preferred management direction. We designed each alternative as a reasonable mix of fish and wildlife habitat prescriptions and wildlife-dependent recreational opportunities, and then we selected our preferred alternative based on their environmental consequences and their ability to achieve the refuge's purpose.

Background

DeSoto National Wildlife Refuge was established in 1958 with the purpose of providing an "inviolate sanctuary" for migratory birds. Land acquisition began that same year. The new refuge's mission statement elaborated on its purpose: *"To preserve and restore indigenous biological communities, with emphasis on wetland and riverine flora and fauna, and to provide both cultural and natural history interpretations for environmental education; and wildlife-dependent recreation, where and when such uses are compatible with the primary purposes of the refuge."*

At present, DeSoto Refuge encompasses 7,823 acres, 3,499 of which are in Harrison and Pottawattamie counties, Iowa and 4,324 in Washington County, Nebraska. The refuge manages a variety of habitats that provide resting, foraging, and nesting opportunities for nearly 250 species of resident and migratory birds. Major habitat types at the start of the year 2000 are woodlands (3,345 acres), freshwater aquatic (900 acres), croplands (1,990 acres), and native grasslands (1,640 acres). DeSoto Lake is a seven-mile long oxbow lake, which contributes 788 acres of aquatic area to the refuge's rich habitat mix. This diversity of habitats supports an abundance of resident plant, mammal, bird, reptile, amphibian, and fish species.



DeSoto Current Land Uses

Category	Percent*
Woodland	42%
Grassland	20%
Cropland	25%
DeSoto Lake	10%
Wetlands	1%
Other	2%
TOTAL	100%

* approximate

Management techniques currently used on the refuge include control of water levels in DeSoto Lake and in wetlands and moist soil units; some biological, chemical and mechanical control of invasive plant species; mowing, haying and prescribed burning of grasslands; biological rotations on cropland; food plots; some tree planting, grass seeding, and hunting of white-tailed deer, snow geese, and other waterfowl.

Adequate long-term management direction does not currently exist for DeSoto National Wildlife Refuge. Management is now loosely guided by general policies and shorter-term plans. A Comprehensive Management Plan written in 1997 is outdated and does not satisfy the requirements of the Refuge System Improvement Act of 1997. A Comprehensive Conservation Plan is needed to address current management issues and propose a plan of action which the Fish and Wildlife Service and its partners can use to achieve the future vision for the Refuge.

Decision Framework

The Regional Director for the Great Lakes-Big Rivers Region (Region 3) of the U. S. Fish and Wildlife Service will use this Environmental Assessment to select one of four alternatives and determine whether the alternative selected will have significant environmental impacts requiring preparation of an Environmental Impact Statement (EIS).

It is recommended that the reader refer to the preceding Comprehensive Conservation Plan for DeSoto National Wildlife Refuge when reviewing this Environmental Assessment. The most relevant information in the CCP is contained in the refuge's proposed "Goals, Objectives and Strategies" as presented in Chapter Five.

A Comprehensive Conservation Plan is needed to address current management issues and propose a plan of action which the Fish and Wildlife Service and its partners can use to achieve the future vision for the Refuge.

Authority, Legal Compliance, and Compatibility

The National Wildlife Refuge System includes federal lands managed primarily to provide habitat for a diversity of wildlife species. National wildlife refuges are established under many different authorities and funding sources for a variety of purposes. The purpose(s) for which a particular refuge is established are specified in the authorizing document for that refuge. These purposes guide the establishment, design, and management of the Refuge. The enabling legislation for DeSoto National Wildlife Refuge can be found in Chapter One of the Comprehensive Conservation Plan.

Additional authority delegated by Congress, federal regulations/guidelines, executive orders and several management plans guide the operation and the management of the Refuge and provide the framework for the Fish and Wildlife Service's proposed action. The key statutes and orders that guide the refuge are summarized in Appendix F of the CCP.

Scoping of the Issues

Scoping is the process of identifying opportunities and issues which would be used to develop various strategic alternatives, one of which will become the proposed action. The Fish and Wildlife Service publicly announced it was preparing a CCP for DeSoto National Wildlife Refuge in December 1997 by publishing a notice in the *Federal Register*.

Scoping involved:

- Issuing news releases
- Conducting a session with a focus group
- Holding a public information and input meeting using the informal Open House approach
- Accepting written comments and concerns

For additional detail on these activities see Chapter Two of the Comprehensive Conservation Plan.

Issues and Concerns

From public involvement activities, the Service received a number of comments that identified issues and concerns people had related to management of the Refuge. These "scoping" issues have been considered in the CCP decision-making process and several have been directly integrated into the Comprehensive Conservation Plan.

This EA informs the public of the impact the proposed action (implementing the CCP) will have on each of four major issue categories. All issues are described in the CCP and many of the goals and strategies contained in the CCP relate to one or more of the issue categories. The four issue categories are listed below along with summaries of the more salient issues under each:

1. Wildlife Populations and Habitat Management

Cropland and Upland Habitats — Initial management at Desoto Refuge emphasized farming grain crops to attract migrating waterfowl and to minimize adverse impacts by these migratory birds on neighboring farms. While this strategy was successful, it may have served to unduly concentrate migrating flocks. Gradually, management emphasis has evolved more toward biodiversity and interest in supporting a broader diversity of flora and fauna. Two thousand acres of refuge land remain in cropland production. The issue facing DeSoto resource managers is whether conversion of cropland acreage to native plant communities should be continued until a well-defined balance of habitat types is achieved. What is the appropriate ratio of habitat types for this particular National Wildlife Refuge?

Cottonwoods and Riparian Forests — A riparian forest of cottonwood trees currently lines one side of DeSoto Lake. The forest structure is threatened because the cottonwoods are not regenerating. The periodic flooding they need for regeneration is prevented by a levee constructed in 1960. The issue facing DeSoto NWR managers is this: Should they attempt to circumvent the process of forest succession now underway (through man-made alterations) in an effort to save the cottonwoods or allow this "unnatural" succession to unfold on its own even of it leads to a less attractive, less ecologically functional forest?

DeSoto Lake and the Missouri River – DeSoto Lake is an oxbow lake created in 1960 by construction of a cut-off levee, separating it from the Missouri River except for gravity flows through inlet and outlet structures within the levee. The effectiveness of these structures is limited by their size and more importantly by the magnitude of river flows. Both low and high lake levels cause problems. The lake also serves as a connection for surface drainage ditches from private land to the river. These ditches carry significant loads of silt and chemicals which jeopardize the long-term life of this oxbow lake environment. When the lake level is too high, these ditches also back up, flooding adjacent private farmlands outside the refuge, which is a strong concern of the affected farmers, as expressed in public scoping and at other times.

Two issues confront DeSoto management: Should DeSoto Lake be reconnected with the Missouri River to restore natural riverine habitat to benefit trust species and riverine fishes? If not, and recognizing that current management practices could ultimately lead to the demise of the oxbow lake environment, should a strong, long-term commitment be made to stabilize DeSoto as a high-quality, unique oxbow lake, even if it means that extraordinary measures must be taken to provide desired lake level and water quality controls?

Snow Geese – In recent years, the mid-continent snow goose population has been growing at 5-8 percent a year (a "doubling time" of just 9-14 years), and now stands at 3 million or more. More geese can be supported in their wintering range, due to expanded refuges and vast areas of cultivated grains, than can be supported in their breeding habitat in the tundra of northern Canada. As a result, snow geese are causing long-term (if not permanent) damage to slow-growing tundra plant communities and other wildlife that depend on these communities.

DeSoto Refuge annually hosts roughly half a million snow geese migrating southward. Over the years, management has successfully attempted to make the refuge an attractive sanctuary for migratory waterfowl, to the enjoyment of hundreds of thousands of visitors. Now, managers must effect a change of course and the public must face the fact that this may be "too much of a good thing." Deliberate population reductions and sanctuary disturbance must be carefully orchestrated along the migration corridors to avoid out-of-control results. What role should DeSoto National Wildlife Refuge play in the international effort to reduce snow geese numbers?

2. Resource Protection

Refuge Facilities – Like all institutions, DeSoto Refuge must live within a budget, and doing so necessitates prioritizing a number of programs and projects that compete for funding and staffing. These include managing endangered species, biodiversity, aquatic and upland habitat, fish and wildlife populations, cultural resources, and public use. DeSoto's unique role as conservators of the artifacts from the Steamboat *Bertrand* is expensive and perpetual. These artifacts are on display in the Visitor Center, which also provides exhibits on natural history and an outstanding view of DeSoto Lake and its migratory waterfowl. The Center and its exhibits and artifacts are costly to maintain. In fact, the backlog of artifact and display problems is growing. How do the Visitor Center and its exhibits relate to high priority wildlife management activities?

Invasive (Unwanted) Species and Animal Damage Control – Exotic organisms increasingly encroach upon the habitats of DeSoto Refuge. These harm the refuge's native flora and fauna by preying on them or competing with them for limited food, space, and resources. Generally, invasive plants are not utilized by native animals for food or shelter as effectively as the native flora. Other wildlife species, although native to the refuge, may be able to cause damage both on and off-refuge. Should DeSoto Refuge managers actively and aggressively combat the ongoing invasion of exotic species by diverting scarce budgetary resources to this mission, or should the refuge adopt a "let nature take its course" approach to all species? How should wildlife populations be controlled to limit their impact on habitat and facilities?

3. Public Education and Recreation

DeSoto Lake Recreational Fishery – DeSoto Lake originally enjoyed a good sport fishery. After years of decline, by the early 1980s, rough-fish (non-game fish) had largely taken over the lake from sportfish. In an effort to restore the sport fishery, refuge managers and state agencies carried out a number of measures to improve aquatic habitat and control rough-fish, including a major renovation in 1985. Since then, more than 35 million sport fish have been stocked in the lake. For a few years, the sport fishery was improved. Yet once again, rough-fish have come to dominate the lake. Should DeSoto Lake fish populations be aggressively managed to maintain a good sport fishery, or should other alternatives be considered, such as the "hands off" approach of allowing the fish species complex to be self-controlled, or even re-connecting DeSoto Lake to the Missouri River, so that riverine species may also utilize the lake? If another intensive, expensive renovation is to take place, what will be the methods used and what will be the source of funding?

4. Partnerships

Role in the Community and Relations with Neighbors – DeSoto National Wildlife Refuge does not exist as an island unto itself. The management actions undertaken on its 7,823 acres affect surrounding landowners, residents, and jurisdictions, the interests of other Federal, state, and local agencies, the public in general, and the larger natural ecosystems of which the refuge is a part. In turn, the actions of these entities have a pronounced effect on wildlife populations, habitat and environmental quality within the refuge.

Over the years, refuge staff have built working relationships and conducted a number of cooperative ventures with stakeholders in the wider community. Still, the refuge is sometimes viewed by its immediate neighbors as wasted area that would be better used as productive cropland. In scoping for the Comprehensive Conservation Plan, both neighbors and representatives of the other Federal and state agencies with which DeSoto staff interact emphasized the importance of the refuge being responsive to their needs and perspectives. Can the refuge find ways to be more accommodating of these other interests without compromising its basic mission?

Chapter 2
Alternatives for Management

Introduction

Four proposed management alternatives were developed during the course of planning the Comprehensive Conservation Plan and complementary Environmental Assessment. These alternatives are discussed within this chapter and summarized in the Alternatives Matrix. Chapter Four of this EA evaluates the alternatives based on issues raised during the planning process.

Formulation of Alternatives

The four alternatives that were developed for this Environmental Assessment range from "No Action" (that is, no change to current management) to "Optimize Natural Resource Conditions and Public Use Potentials." All four alternatives would serve the primary purpose for which the Refuge was established but the end results would vary, in some ways substantially. Refuge and Service goals and objectives play an important role in the variances that would result from implementation of any one of the alternatives. These alternatives also respond in different ways to the concerns voiced by stakeholders in the focus group and public scoping meetings.

The four alternatives are:

Alternative A: No Action — Current management practices would continue.

Alternative B: Maximize Restoration and Conservation of Historical Natural Resource Conditions — Under this alternative, management would aim to restore pre-settlement, natural resource conditions on the refuge.

Alternative C: Maximize Compatible Public Use Potentials — Refuge management would emphasize the six compatible, priority wildlife-dependent uses.

Alternative D: Optimize Natural Resource Conditions and Public Use Potentials (Preferred) — Management would seek the best or optimal balance between the competing ideals of natural resource conservation and public use.

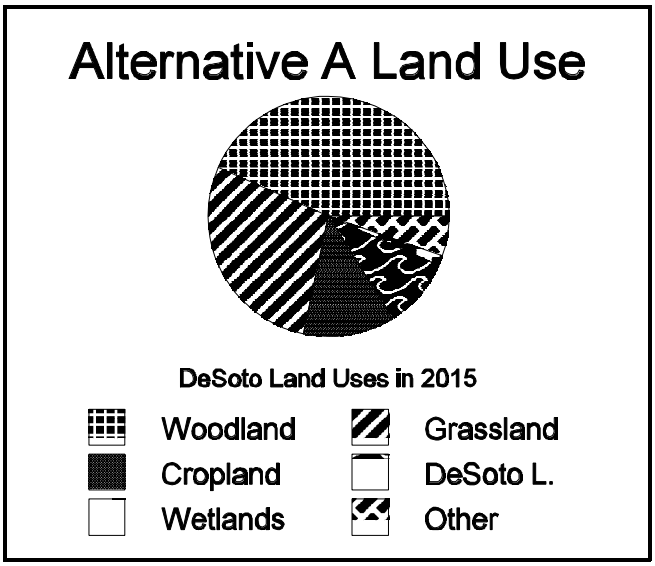
Descriptions of Alternatives

The four alternatives discussed below were the only ones considered and developed.

Alternative A – No Action (Current Management)

This alternative assumes no major changes in existing management goals and objectives. Realization of the defined goals and objectives has been significantly limited by shortages of staffing and funding. The previously approved Comprehensive Management Plan would be developed as the CCP. No programs would be expanded.

It should be emphasized that No Action does not mean static conditions nor static management. For example, current management calls for gradual reduction in the acreage of farmland from about 1990 acres to approximately 1000 acres with proportional increases in managed native grasslands, woodlands, and wetlands.



Alternative A -- Land Uses in 2015

Category	Percent*
Woodland	45%
Grassland	30%
Cropland	12%
DeSoto Lake	10%
Wetlands	1%
Other	2%
TOTAL	100%

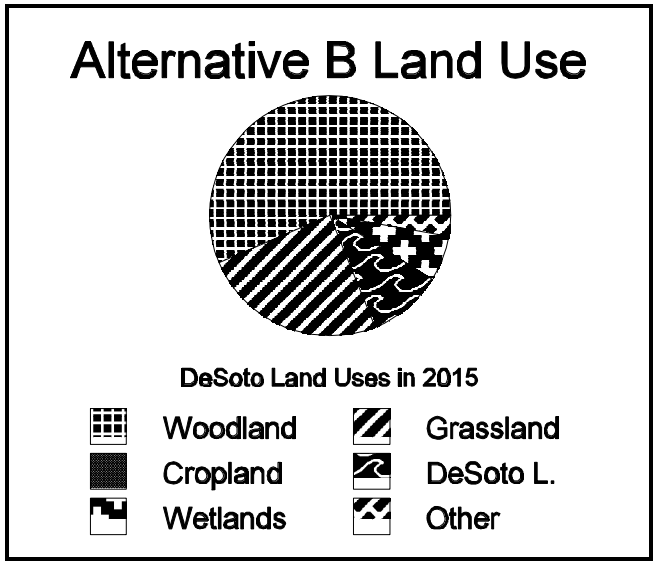
*approximate

Alternative B – Maximize Restoration and Conservation of Historical Natural Resource Conditions

Alternative B emphasizes management strategies to restore and conserve fish and wildlife populations, species and habitat diversity, composition and abundance to levels and conditions existing in the pre-development era (that is, to about the mid-1800's). Actions would be taken to conserve existing Missouri River floodplain and riparian habitats and restore them to historic conditions where they are absent, degraded or declining. Renewed emphasis would be placed on maintenance and restoration of native flora and fauna, particularly threatened and endangered species.

Levees along the Missouri River would be modified to re-connect the river to its floodplain within the refuge and re-establish hydrologic and geomorphological conditions (flooding, scouring, erosion, deposition, early successional stages, etc.) to the maximum extent possible in a highly altered and extensively developed and regulated river ecosystem. Existing compatible public uses would continue, but would be de-emphasized or limited in areas or situations where these activities conflict with developing maximum mid-1800's resource values.

It should be emphasized that the future land use percentages under this alternative are highly speculative. The only one known with certainty is 0% cropland. The percentages of other land use and habitats types depend not only on unpredictable floods along the Missouri River but also on particulars of how the river's fluvial processes would interact with DeSoto Lake and adjacent floodplain habitats once flows were restored. This is extremely difficult to predict at this scale, which is why selecting this alternative would necessitate a detailed feasibility study of the engineering, hydrological, and environmental repercussions of reconnecting the lake to the river.



Alternative B -- Land Uses in 2015

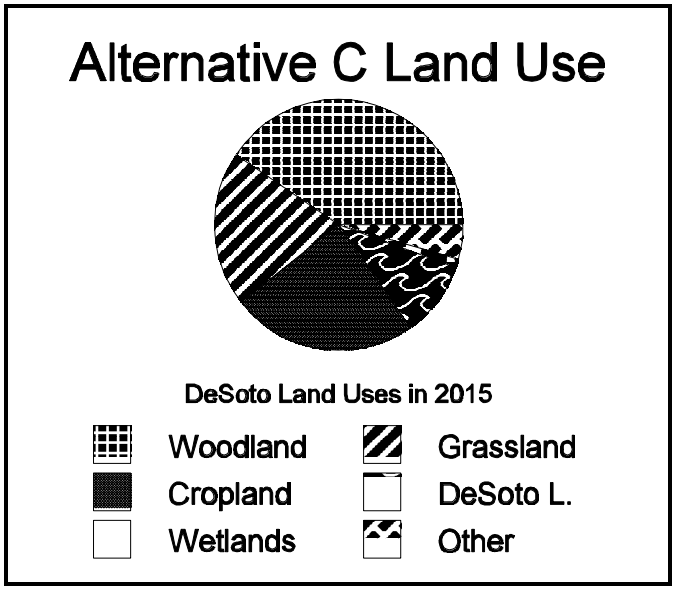
Category	Percent*
Woodland	57%
Grassland	25%
Cropland	0%
DeSoto Lake	10%
Wetlands	6%
Other	2%
TOTAL	100%

*approximate and highly speculative

Alternative C – Maximize Compatible Public Use Potentials

Under this alternative, the six priority wildlife-dependent uses originating with the Refuge Improvement Act (interpretation, education, observation, photography, hunting, fishing) would be promoted and enhanced. Public use and environmental education efforts and outreach would be stepped up considerably. Additional public use opportunities would be encouraged while attempting to minimize impacts to other refuge programs such as habitat management, fish and wildlife populations, and resource protection. Additional facilities would be developed on the refuge to accommodate increased public use.

Management, conservation, and interpretation of the *Bertrand* Collection would be enhanced and maximized. Additional staff and funding would be necessary to promote additional interpretation and conservation. The current exhibit would be dramatically changed and would emphasize the role of the steamboat era to the Westward expansion, thus changing the ecology, land use, and wildlife populations of the American West forever. Additional focus on the importance of National Wildlife Refuges after the expansion and its subsequent changes would be promoted. Other refuge facilities would continue to be protected at current levels. Current management practices would continue or in some cases be decreased as funding, staffing, and resources were shifted toward maximizing public use.



Alternative C -- Land Uses in 2015

Category	Percent*
Woodland	42%
Grassland	20%
Cropland	25%
DeSoto Lake	10%
Wetlands	1%
Other	2%
TOTAL	100%

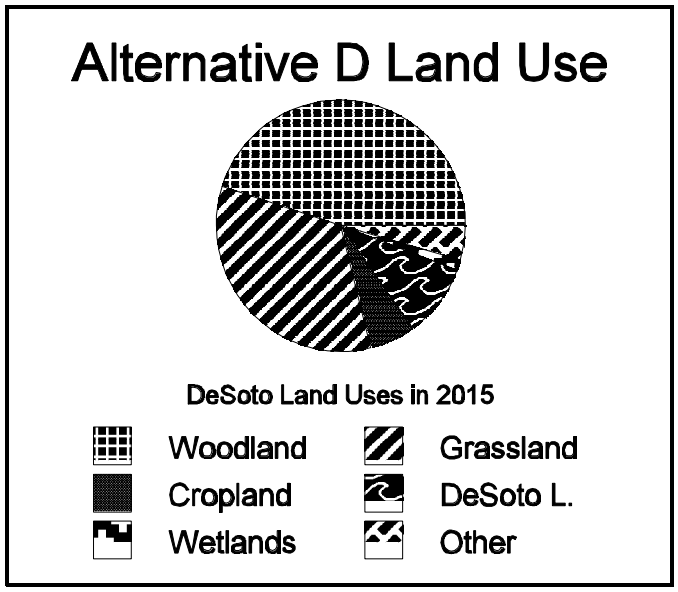
*approximate

Alternative D – Optimize Natural Resource Conditions and Public Use Potentials (Preferred Alternative)

This alternative seeks neither to maximize natural resource conservation nor compatible public uses. Rather, it recognizes that maximization of either of these may interfere with the other. Thus, Alternative D – the Preferred Alternative — seeks the best or optimal balance between the sometimes competing ideals of wildlife conservation, habitat restoration, and public use.

In terms of habitat management, a more concerted effort than at present would be made to conserve and restore a mosaic of habitat types representative of the Missouri River ecosystem in the mid-1800's. Greater reduction in refuge cropland would be achieved than in Alternative A (acreage would be reduced by 75%, down to 475 acres). Habitat manipulation on behalf of threatened and endangered species would continue and be intensified, as opportunities permit. In general, large blocks of like habitat would be preferred over patches and fragments. In contrast to Alternative B, DeSoto Lake would be maintained as a unique, oxbow lake environment, unless a decision is made to reconnect DeSoto Lake with the river; its water quality would be improved and its physical attributes preserved over time. A feasibility study would be conducted of re-routing agricultural drainage ditches now emptying into the lake; the alternative of constructing sediment traps would also be investigated. To address the problem of excessive water levels in the lake, the possibility of a new outlet toward Wilson Island Chute would be studied, as would the effectiveness of enlarging the lake outlet.

With regard to fish and wildlife population management, commercial fishing for lake rough fish would continue, as would stocking of sport fish. Bald eagles and other threatened and endangered species would be actively promoted through a variety of direct and indirect means. Populations of all species, particularly sensitive ones, would be monitored regularly. Snow geese populations would be actively managed, which for the foreseeable future, means participation in mid-continent efforts at reduction.



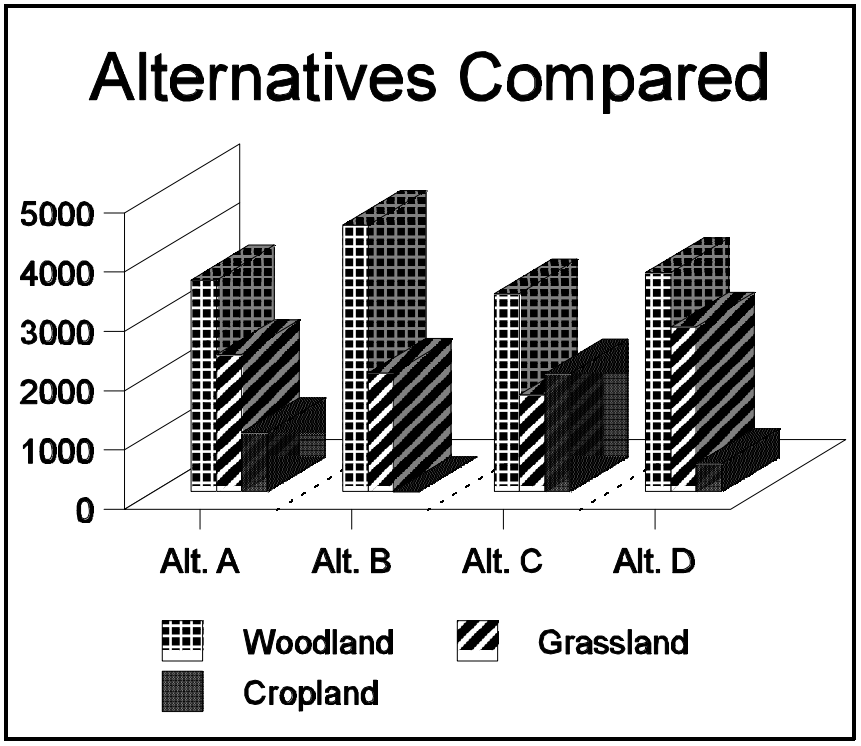
Alternative D -- Land Uses in 2015

Category	Percent*
Woodland	46%
Grassland	35%
Cropland	6%
DeSoto Lake	10%
Wetlands	1%
Other	2%
TOTAL	100%

* approximate

With regard to resource protection, greater support than at present would be given to protecting natural and cultural resources, including the natural history exhibits and the *Bertrand* collection. All six priority public uses would be encouraged to an even greater extent than at present. Other compatible uses would be seriously considered. Cooperation with partners would increase.

The chart below compares the three major land uses/habitats --woodlands, grasslands, and croplands -- that vary from one alternative to another. The ratios of these three habitats in Alternative A diverge somewhat from the present. The ratios in B vary sharply from the present, especially because there is no cropland. Alternative C habitats are the same as those at present. Alternative D has greater amounts of woodlands and grasslands than the current mix.



Chapter 3
Affected Environment

The following discussion summarizes more detailed information found in the attached CCP.

General

Surrounded by a landscape dedicated primarily to growing corn and soybeans, DeSoto National Wildlife Refuge is dedicated to managing semi-natural habitat for the benefit of waterfowl and other wildlife. With its unique Steamboat *Bertrand* Collection, it is also a place "where wildlife and history meet." Each autumn the refuge hosts hundreds of thousands of migratory waterfowl, particularly snow geese but many other species as well, on their way south for the winter. The refuge also contains DeSoto Lake, a 7-mile long oxbow lake that provides boating, fishing, and wildlife viewing opportunities. The Missouri River itself bisects the refuge. DeSoto embraces a diversity of habitats, including riparian or floodplain woodlands, managed native grasslands, wetlands, and low-input croplands on a "biological rotation."

Climate

The climate of DeSoto National Wildlife Refuge is characteristic of mid-latitude, mid-continental regions. Annual precipitation (rainfall and snowfall combined) is approximately 30 inches; average snowfall is 29.5 inches. As typical of areas with continental climates, there are wide temperature fluctuations between the seasons.

Geology, Hydrology and Soils

DeSoto NWR is situated entirely within the historic floodplain of the Missouri River. Although the refuge is now separated from the river by a levee, DeSoto's landforms, its soils and its oxbow lake are all a direct result of the natural fluvial processes of meandering, deposition and scouring carried out by the Missouri over the millennia.

As a consequence of the historic cycle of annual floods as well as the Missouri's tendency to carve new river channels, DeSoto Refuge soils were formed from coarse to fine-textured recent alluvium (river-deposited sediments). These soils are generally low to moderate in organic matter, calcareous, ranging from neutral to moderately alkaline. Available phosphorus is generally low, while the supply of available potassium is generally high. Permeability (ability of water to percolate through) ranges from rapid to slow. In some areas, clays and loams form the upper layer of the soil and are underlain by fine sand and sandy loams. Loams are generally fertile soils, usually containing a significant amount of organic matter.

Some areas on the refuge contain soils consisting entirely of clay, and some all of sand. Still other sites have sandy loams over clay or clay loams. Most refuge fields do not have consistent soil types throughout, requiring varying management strategies.

Wetlands

The National Wetlands Inventory has identified approximately 1,560 acres of 32 different types of wetlands on DeSoto Refuge. DeSoto Lake and the Missouri River together comprise about 60 percent of this total wetland acreage. Temporarily flooded riparian forests adjacent to the river are also included. (Due to the levees along the river banks these forests may no longer flood with any regularity.) At present, staff are actively managing 101 acres of marsh-like wetlands and moist soil units on the refuge.

Vegetation

Woodlands — It is likely that most of what is now DeSoto National Wildlife Refuge was once covered with bottomland forest, although the continual shifting and meandering of the river channel probably removed the forest cover periodically and maintained some areas in prairie grass.

Currently, DeSoto contains approximately 3,345 acres of riparian woodlands and brushlands. Cottonwood (*Populus deltoides*) is the predominant canopy tree in this forest type. Reaching 100 feet or more in height, it towers above all other trees in the floodplain. These stands were likely established when the Missouri River was actively flooding, scouring and depositing soils in natural processes that are no longer occurring on a regular basis. Today, in the absence of this dynamic force, proper conditions for the regeneration of cottonwood stands rarely occur.

Concerns have been raised regarding minimal regeneration of this species (at DeSoto and wherever else floodplains are no longer flooded). Old cottonwoods are currently being replaced by more shade-tolerant species that do not depend on flooding, such as hackberry (*Celtis occidentalis*), red mulberry (*Morus rubra*), and green ash (*Fraxinus pennsylvanica*), which may result in improved mast (fruit and nut) production as these species become dominant. However, at the present time, the most obvious successional change is a dense midstory of roughleaf dogwood (*Cornus drummondii*), averaging 10-12 feet in height.

Other common trees of DeSoto Refuge's floodplain woodlands include black willow, sandbar willow, black walnut, boxelder, eastern red cedar, and the exotic Chinese elm.

Native Grasslands — The exact extent to which the lands that are now DeSoto Refuge were covered by native prairie grasslands (versus floodplain woodlands) prior to modern settlement and agriculture is unknown. What is known is that DeSoto now supports native grass species found in both the tallgrass and shortgrass prairie. The refuge is located in the transition zone between the two, with the true tallgrass prairie to the east and the shortgrass prairie further to the west. At present, managed grasslands dominated by native species occupy approximately 1640 acres at DeSoto in units scattered throughout the refuge.

The native grasses found at DeSoto NWR include sideoats grama *(Bouteloua curtipendula*),

little bluestem (*Andropogon scoparius*), swwitchgrass (*Panicum virgatum*), Canada wild rye (*Elymus canadensis*), big bluestem (*Andropogon gerardi*), sand lovegrass (*Eragrostis trichodes*), eastern gramagrass (*Tripsacum dactyloides*), Indiangrass (*Sorghastrum nutans*), buffalo grass (*Buchloe dactyloides*), and blue grama (*Bouteloua gracilis*).

Croplands — At one time almost half the refuge was cultivated. The rationale for cropland was that it provided food and loafing areas for migrating waterfowl, and food, cover, and edge for other wildlife species. Since the 1970s the acreage devoted to cropland has gradually been reduced. At present approximately 1990 acres (about one-quarter) of the refuge are maintained in a low-input (minimal fertilizers and no insecticides) "biological rotation." The principal crops are corn, soybeans, sweet clover, milo, alfalfa, and grass hay.

Fish and Wildlife

Birds, Mammals, Reptiles, Amphibians, and Other Wildlife — DeSoto NWR's mosaic of habitats support a number of vertebrate species, which are listed in Appendix E of the attached CCP. Although wildlife habitats and populations on the refuge have been drastically altered by human activities ranging from channelization of the Missouri River to agricultural cultivation, DeSoto still contains significant wildlife resources due to its proximity to the Missouri, its location along principal migratory flyways, and as a result of the Service's management and conservation efforts.

In typical years, hundreds of thousands of snow geese utilize the refuge as a resting and feeding area during their fall migration between Arctic nesting grounds and Gulf Coast wintering areas. These spectacular concentrations are generally seen in November and December; smaller concentrations occur in March and early April. Canada geese show up at DeSoto as well, though in much smaller numbers. Peak populations of 70,000 or more ducks, mostly mallards, but also more than 20 other species, utilize the refuge during fall migration. Peak duck populations are significantly down in recent years.

Each fall, numerous bald eagles follow the geese into the refuge and out of it again, as the migration proceeds south. As many as 143 have been observed at one time. Eagles are often found perched in cottonwoods along DeSoto Lake when waterfowl are present.

DeSoto's woods and fields attract a variety of songbirds, including neotropical migrants, and other resident wildlife. During migration periods, warblers, gulls, herons, and egrets abound. White pelicans and cormorants usually stop in the area for several weeks during their migrations. Owls, pheasants, and bobwhite quail are common too, and remain on the refuge year around. Overall, almost 250 different avian species have been reported on the refuge.

Approximately 300 white-tailed deer make the refuge their home. Many local visitors drive the auto-tour loop at dusk to see the deer grazing in the fields. Other mammals found in woods and fields include cottontail rabbits, raccoons, skunks, badgers, coyotes, opossums, and fox squirrels. Coyotes are often seen resting on the ice-covered lake on sunny winter days. Backwater areas of DeSoto Lake and several wetlands serve as habitat for beaver, muskrat, and mink. Foxes, weasels

and other animals also occur on the refuge. Overall, about 40 species of mammals have actually been identified on DeSoto, or are strongly suspected to be present, including two species of shrew, eight bats, eight carnivores, seventeen rodents, and two species of rabbits.

The presence of about 30 reptile species is known or inferred at DeSoto, including seven turtles, three skinks, and 21 species of snakes. At least ten species of amphibians have been observed on the refuge, including two species of salamanders, three toads, and five species of frogs. Appendix E provides species lists.

Fish – There are two main communities of fish that occur on DeSoto Refuge – those species that live in DeSoto Lake, many of which are stocked for their sport-fishing qualities, and the naturally-occurring riverine species that are found in the Missouri River where it cuts across the refuge. DeSoto Lake contains a number of stocked game fish species, including largemouth and white bass, black and white crappie, channel and flathead catfish, bluegill, green sunfish, walleye, and northern pike. Among the rough-fish whose populations have grown in recent years are carp, buffalofish, and gizzard shad. Gizzard shad dominate the lake's biomass and are undoubtedly providing a considerable food source for predator fish.

More than 80 species of fish are found in the lower Missouri River and may possibly occur within the reach that bisects DeSoto Refuge, including one or more species of sturgeons, gars, chubs, carp, shiners, catfishes, basses, crappies and minnows. These are listed in Appendix E of the CCP.

Threatened and Endangered Species — There are no year-round resident federally threatened or endangered species at DeSoto NWR. However, three federally threatened/endangered bird species do visit the refuge ranging from regularly to infrequently: the bald eagle, least tern, and piping plover. A fourth federally-listed species — the endangered peregrine falcon — is a rare visitor to the refuge.

- The **bald eagle** (*Haliaeetus leucocephalus*), a threatened species that the Service plans to de-list, is a common visitor in the fall and spring months but has never successfully nested on the refuge.

- The **least tern** (*Sterna antillarum*) interior population is an endangered species. Least terns used to nest on the refuge as recently as the 1970s but are now observed only sporadically. Dams, reservoirs, and other changes to river systems, including the Missouri, have eliminated most historic least tern habitat in the Mid-West.

- The **piping plover** (*Charadrius melodus*) is also a federally listed endangered species. It too used to nest at DeSoto Refuge until the 1970s. As many as 100 individuals and 20 plover nests were documented in the mid-1960's. The last piping plover observed at DeSoto was in 1977. It is in trouble throughout its range because of habitat loss/degradation and nest disturbance and predation.

In addition to the above three federally protected birds, one endangered fish — the **pallid sturgeon** *(Scaphirhynchus albus*) — is found within the Lower Missouri ecosystem, though it is scarce. Extensive riverine habitat modification has led to its decline. Its presence within the short reach of the Missouri flowing through the refuge is unlikely, but possible. Two other fish, the **sicklefin chub** (*Macrhybopsis meeki*) and the **sturgeon chub** (*Macryhbopsis gelida*) have declined for the same reasons and are candidates for listing.

Land Use and Zoning

DeSoto NWR is located in one Nebraska and two Iowa counties with primarily agricultural land use. The portion of the refuge (4,615 acres, or 59%) in Washington County, Nebraska, is zoned A-1, agriculture/farming, a category which includes forest and conservation areas as well as public parks and certain other outdoor recreation facilities. The portion (2,582 acres, or 33%) in Harrison County, Iowa, is zoned C-1, Conservation District, a category which includes parks, outdoor recreation areas and conservation reserves. Finally, the portion (626 acres, or 8%) in Pottawattamie County, Iowa, is zoned A-1, open space and conservation. The Zoning Departments of all three counties consider the refuge to be consistent with their land use plans.

Within the 7,823-acre refuge itself, at present, approximately 40 percent of the refuge is wooded, 25 percent is cultivated cropland (including fallow areas), 20 percent is grassland, 10 percent is DeSoto Lake, and the remaining five percent a combination of the Missouri River, wetlands, and developed sites (roads, parking lots, buildings, etc). In the coming years, as cropland is retired, the percentage of that land use will decline and those of woodlands and grasslands will increase.

Contaminants and Water Quality

DeSoto Lake has had ongoing problems with water quality, both because of runoff laced with fertilizers, sediments, and pesticides from the agricultural land uses that predominate in the 12,000-acre upstream drainage basin of the lake and because of the high concentrations of fish and waterfowl that live in or use the lake. High inputs of organic substances and nutrients push the lake toward eutrophication, two symptoms of which are low dissolved oxygen (DO) and summer algal blooms. Low DO in DeSoto Lake has caused fish kills occasionally (though less frequently in recent years). Algal blooms also reduce oxygen, interfere with other more desirable aquatic organisms, and are aesthetically unattractive in and of themselves. Fish kills from low DO led to the installation of an artificial aeration system in 1985, which has helped reduce the severity of the problem.

In addition to low DO, the lake has also suffered from high turbidity (poor water clarity), believed to be a function primarily of rough-fish stirring up and re-suspending bottom sediments.

As well as the very tangible, visible problems with dissolved oxygen and turbidity, there are more hypothetical concerns over whether toxins — primarily residues of pesticides used in agriculture — could be contaminating the lake's water and sediments, and through the phenomenon of bio-

magnification, accumulating to even higher concentrations in fish and the creatures that feed on fish. A limited amount of sampling and testing for pesticides in the lake has been conducted, which has detected chronic concentrations at low levels.

Socioeconomic Environment

Because it straddles the present Missouri River channel as well as the historic one, DeSoto NWR is located in three counties and two states: Harrison and Pottawattamie counties, Iowa and Washington County, Nebraska. The refuge is located about midway between Missouri Valley, Iowa, and Blair, Nebraska along U.S. Highway 30, which abuts its northern edge. Interstate 29, five miles to the east, is a major route from central Canada to Omaha, Nebraska and Kansas City, Missouri. Interstate 80/680, a trans-continental route, is eight miles southeast.

Harrison County, Iowa is a largely rural county with a substantial farming presence. Its 1998 population was estimated at about 15,360, up 4.3 percent from the 1990 population of 14,730. The population is about 99 percent white. Washington County, Nebraska is also a largely rural county with a large farming presence. It's 1998 population was estimated at about 18,660, up 12.4 percent from the 1990 population of 16,600. The population is about 99 percent white.

About eight percent of DeSoto Refuge, the southeastern corner, falls into Pottawattamie County, Iowa. This county includes the town of Council Bluffs, directly across the Missouri River from Omaha, Nebraska. The 1999 estimated population of Pottawattamie County was 86,425, about two-thirds of whom live in Council Bluffs, where the largest employers are casinos, an insurance company, and two hospitals. Over 95 percent of the county is non-Hispanic white. Agriculture is a much smaller part of the economy and way of life in Pottawattamie County than in either Harrison or Washington counties.

Spending associated with wildlife observation, hunting, and fishing generates a substantial amount of economic activity across the United States, and DeSoto National Wildlife Refuge is no exception. Total annual expenditures related to DeSoto visitation are approximately $6.8 million, of which about 98% is from wildlife-watching. This spending in turn generates economic activity — increased output, jobs, income, and tax revenue — throughout the local and regional economy. The total annual industrial output from DeSoto is estimated at $11.7 million; this is associated with approximately 190 jobs, $3.2 million in annual job income, $340,000 in state sales tax revenue, and $121,000 in state income tax revenue. Other economic benefits accrue from DeSoto's payroll, equipment and supply purchases, and income to cooperating farmers.

Cultural Resources

Cultural Resources Background and Potential — As of May 1, 2000, Harrison and Pottawattamie counties in Iowa and Washington County in Nebraska contain 27 properties on the National Register of Historic Places. One is the *Bertrand* site and collection on DeSoto Refuge. The others are not in the vicinity of the refuge and are likely not representative of cultural resources on the refuge.

DeSoto Refuge contains 13 reported or surmised cultural resources sites, all of which are historic period Western culture sites. Just under 200 acres of the refuge have been subjected to archaeological survey. Historical and geological evidence and assumptions indicate the shifting Missouri River has erased all prehistoric and most historic period archeological sites that may have existed within the Refuge boundaries, although the Iowa State Historic Preservation Officer criticized the 1978 Blakeslee survey for not including subsurface testing for buried occupation layers.

Steamboat *Bertrand* Collection — DeSoto NWR's Visitor Center is home to a premier archaeological collection of 200,000 artifacts excavated from the buried hull of the Steamboat *Bertrand*, which sank in 1865 on what is now the refuge. The Visitor Center houses these artifacts, which include not only the necessities of clothing, tools, and food, but also comparative luxuries like olive oil and mustard from France, bottled tamarinds and a variety of canned fruits, several varieties of alcoholic beverages called bitters, powdered lemonade in a can, and brandied cherries.

A state-of-the-art, collection storage area protects the cargo of the boat. Visitors may view this area through a glass wall, 150 feet in length. A conservation lab for artifact preservation, collection research area and library, are staffed by museum professionals. The center also contains a theater and exhibition galleries. Permanent exhibits discuss the impact steamboat cargoes and passengers had on the frontier through town-building, farming, logging and mining.

Public Use

Visitation and recreation by the public are encouraged on national wildlife refuges for activities that are compatible with the refuge purpose and mission. There are six priority, wildlife-dependent public uses: wildlife observation, photography, environmental education, interpretation, hunting, and fishing. DeSoto National Wildlife Refuge has all of these.

DeSoto NWR is one of the more heavily visited national wildlife refuges. In the 1960's visitation averaged about 197,000 per year. In the 1970s the annual average climbed to 341,000 per year, and in the 1980's it rose yet again to 396,000, with a single year peak of 473,038 visitors in 1982. From 1990 to 1999 (the most recent year for which figures are available), visitation dropped somewhat to an annual average of 295,000.

The great preponderance of visitors to DeSoto come to observe wildlife and to partake of the interpretive opportunities in the Visitor Center, with smaller numbers coming for environmental education, hiking/walking, fishing, and hunting. November is usually the busiest month of the year, coinciding with the fall snow goose and waterfowl migration. Visitor Center staff estimate that about 50 percent of visitors are non-resident, that is, they come from more than an hour's drive away.

Chapter 4
Environmental Consequences

Effects Common to All Alternatives

The four alternatives were developed to address most of the issues, concerns, and opportunities identified during the planning process. The specific consequences for each alternative are depicted in the following Alternatives Matrix. The alternatives share a few dimensions that are discussed together here.

Cultural Resources

The potential for any given project to affect prehistoric and historic resources and Native American human remains and cultural objects will be determined early in the planning phase of a project. The procedures in 36 CFR 800 implementing Section 106 of the National Historic Preservation Act, the Iowa/Nebraska Programmatic Agreement, the requirements of the Native American Graves Protection and Repatriation Act, and the policies and standards specified in the Fish and Wildlife Service Manual 614 FW 1-5 will be followed in all cases.

Other Topics

The topics of air and noise pollution, waste management, and environmental justice were not raised as issues during scoping. None of the alternatives discussed below and displayed in the Alternatives Matrix would generate impacts of concern in these areas.

Effects that Vary Between Alternatives

The Alternatives Matrix following the alternatives summaries below evaluates the four alternatives according to their differential effects on 30 issues/concerns/opportunities. This matrix was developed during a three-day workshop held in October, 1999 with refuge staff, regional staff, and a consultant. The major differences are summarized briefly below:

Alternative A – No Action (Current Management)

Under current management, acreage of cropland will be reduced by about half over the coming 15 years. Most reverted cropland will be converted to managed, native prairie grasslands, and some will be converted to bottomland forest both by active planting and/or seeding and passive, successional reforestation. This additional habitat will benefit most indigenous resident and migratory birds that depend on grassland or woodlands for nesting, resting, and foraging.

However, certain game animals like white-tailed deer, quail, and turkey that feed on grains may see their refuge carrying capacity reduced. Snow geese are unlikely to be affected.

Phasing out approximately 50% of the current refuge cropland acreage will cut in half the estimated gross annual receipts of $206,000 earned by eight cooperative farmers. However, this reduction will take place by means of voluntary attrition and over a 15-period, minimizing any economic hardship. Moreover, those farmers who have three-year leases with DeSoto have known for many years that croplands are being cut back. This reduction has now been underway for more than a decade and has already removed more than 1,000 acres of cropland from DeSoto.

Other refuge programs and activities will continue as they have, including monitoring of DeSoto Lake water quality, managing the sport fishery, preserving the *Bertrand* Collection, the deer and waterfowl hunts, and visitor programs. Funding will continue to be a constraint. Most of the outstanding issues and concerns cited earlier and in the CCP would linger.

Alternative B – Maximize Restoration and Conservation of Historical Natural Resource Conditions

Alternative B emphasizes the restoration of fish and wildlife populations, species and habitat diversity, composition and abundance to levels and conditions existing in the pre-development era. All cropland would be phased out over the coming 15 years, and natural succession would be allowed to run its course on both croplands and native grasslands. The only intervention in the plant community succession process would be to control non-native, invasive plant species. This being the case, not only would croplands revert to grasslands, but some managed grasslands now kept free of woody plants by mowing and prescribed burning are likely to return to bottomland forests, especially if seasonal flooding is permitted. Cottonwoods, which are now in decline in the refuge's forests as a result of the lack of flooding, would likely continue to do so. Rough-leaf dogwood (*Cornus drummondii*) would likely take over.

Phasing out all refuge cropland acreage would eliminate the estimated gross annual receipts of $206,000 earned by eight cooperative farmers. This phaseout would not be voluntary, as under Alternative A, but it would occur over a 15-year period, which would provide time for farmers to adjust. Moreover, those farmers who have three-year leases with DeSoto have known for many years that croplands are being cut back. This reduction has now been underway for more than a decade and has already removed more than 1,000 acres of cropland from DeSoto. Also eliminated would be surplus grains and inter-elevator grain transfers to other field stations.

DeSoto Lake would be reconnected to the Missouri River, so that the natural, fluvial processes of flooding, deposition, scouring, and erosion would once again occur within DeSoto Bend — to the extent possible in a river whose discharges are heavily regulated by dams. Levees would have to be built around the refuge, to prevent possible flood damage to adjoining properties. However, refuge facilities including the Visitor Center, headquarters, roads, and trails would remain at risk to flooding, erosion, and sedimentation. The consensus of participants in the three-day Alternatives Workshop at DeSoto in October, 1999 was that DeSoto Bend would eventually silt

in or be cut off, as oxbows eventually are. In any case, in the near term, DeSoto Lake would cease to exist as a hydrologically and biologically separate entity. The managed sport fishery would cease to exist and would be replaced by an opportunistic fishery oriented toward riverine species. However, certain riverine species, including the endangered pallid sturgeon, may find more suitable habitat in the sloughs and backwaters that could conceivably develop in what is now DeSoto Lake.

Eliminating the still waters of DeSoto Lake would probably make the refuge much less attractive as a sanctuary and stopover for migratory waterfowl. Water courses with currents do not lend themselves to resting and sleeping by migrating ducks and geese. The replacement of adjacent croplands with bottomland forest and native grasslands would also tend to attract fewer waterfowl. However, native resident and migratory songbirds and other vertebrate species dependent on or with a preference for woodlands, wetlands, and grasslands would benefit from additional habitat.

Public use and recreation would be significantly altered under this alternative. Hunting and fishing opportunities would almost certainly diminish because of the loss of cropland and the lake. For most refuge visitors who now come to observe and photograph the annual snow goose spectacle every fall, in all probability there would be fewer geese and waterfowl in general to observe. As mentioned above, the Visitor Center and other public use facilities would also be at greater risk to damage from flooding, which would have adverse repercussions on visitation. The *Bertrand* Collection, which DeSoto NWR has a legal obligation to preserve, could be forced to move to a more secure facility. On the other hand, with the refuge converted into a large "natural laboratory" for native habitat restoration, there would be ample, perhaps even expanded, opportunities for environmental education, interpretation, and research.

This alternative represents a radical departure from the traditional management of the refuge; careful analysis of its potential impacts, as proposed in Chapter 5, Objective 1.7.1 will be necessary to determine its feasibility.

Alternative C – Maximize Compatible Public Use Potentials

Under this alternative, the six priority wildlife-dependent uses originating with the Refuge System Improvement Act (interpretation, education, observation, photography, hunting, fishing) would be promoted and enhanced. Public use and environmental education efforts and outreach would be stepped up considerably.

Wildlife population and habitat management would be oriented toward embellishing DeSoto's natural assets and attractions in such a way as to draw more visitors to the refuge and give them even more rewarding and informative experiences than they currently enjoy. To some extent, funding priorities would also be shifted away from land and resource management per se in the direction of providing more and better facilities and programs for the public.

Croplands would be kept at their current level (almost 2,000 acres) because they help attract and feed deer, wild turkey, snow geese, and other waterfowl, all of which have high visual appeal,

thus providing enjoyment to the viewing public. Food plots would be placed and maintained in locations accessible to public viewing. By maintaining cropland acreage, cooperative farmers could continue cultivating the refuge indefinitely, maintaining their income from refuge farming. DeSoto would continue to share excess grains with other refuges via inter-elevator transfers.

Maintaining cropland on DeSoto may also help decrease depredation by deer and other game animals on adjacent private farmland by providing an ample food source within the refuge. It would also likely help maintain the deer herd, and populations of other game birds like turkey, pheasant, quail, ducks and geese at current levels, which will maintain or even augment current hunting opportunities on the refuge. However, native non-game birds dependent on grasslands and woodlands would not benefit from increased habitat for nesting, feeding and cover under Alternative C, as they would (to different degrees) under the other three alternatives.

Bottomland forests would continue to change in tree composition, notably with the continued loss of cottonwoods, the dominant canopy species at present. Accompanying the decline of cottonwoods are a projected decline in tree cavities valuable to many species and perches favored by bald eagles. The extent to which the affected species could "make do" with less ideal nesting, resting, and cover structures is unknown.

DeSoto Lake would be managed intensively as a stabilized, manmade oxbow lake supporting a recreational fishery with tremendous potential. The lake would be renovated on a regular basis, depending on trends in aquatic habitat, water quality, and the species composition of its fish biomass. Once rough-fish reached a certain level of sustained dominance, a renovation would be undertaken, which could include a lake drawdown and/or chemical treatment with Rotenone or whatever substitute is permissible. Plantings would be carried out with submerged aquatic plants that improve both aquatic habitat and water quality. The lake shore would be further stabilized with riprap to prevent erosion. Lake water quality, habitat, and fish populations would be monitored intensively through a variety of means. The means would be sought to lower the water level in the lake, which is critical to achieving its recreational potential.

Maintaining abundant fish populations in DeSoto Lake would help continue to attract bald eagles, some species of water birds, shorebirds and wading birds to the lake.

Under Alternative C, the possibility of constructing a campground near the South Gate entrance in conjunction with Iowa DNR and Wilson Island State Park would be seriously considered. If a campground were built, it would augment DeSoto's recreational value to the public. However, the compatibility of camping with the refuge purpose and mission would have to be determined. Greater activity in that area would certainly necessitate greater law enforcement efforts and expenditures on the refuge. It would likely concentrate and intensify fishing, canoeing, and boating in that reach of the lake.

Overall, this alternative would satisfy those concerns related to public use and recreation, being a "good neighbor," and maintaining refuge facilities. However, except for promoting several "photogenic" wildlife species, it would generally give short shrift to wildlife, habitat and broader ecological concerns such as enhancing biodiversity and engendering freer rein to ecosystem processes.

Alternative D – Optimize Natural Resource Conditions and Public Use Potentials (Preferred Alternative)

This alternative would neither maximize natural resource conservation nor compatible public uses at DeSoto. Rather, it seeks the best or optimal balance between the sometimes conflicting objectives of wildlife conservation, habitat restoration, and public use.

Alternative D would reduce the current acreage of cropland by about three-quarters over the coming 15 years, down to about 6% of the total refuge area (from 25% today). Most reverted cropland would be converted to managed, native prairie grasslands (more than 1,100 acres, bringing total grasslands up to 2780 acres), and some would be converted to bottomland forest (about 350 acres, bring total woodlands up to 3700 acres), both by active planting and/or seeding and passive, successional reforestation. This additional habitat would benefit those indigenous resident and migratory birds, and other native species, that depend on grasslands or woodlands for nesting, resting, and feeding. However, certain resident game animals that prefer to feed on grains may see their refuge carrying capacity reduced. Snow geese are unlikely to be affected.

Under Alternative D, there might be somewhat fewer hunting opportunities for white-tailed deer if reductions in cropland lead to a reduced deer population. However, the projected mix of grassland and woodland habitats should also be very favorable to the refuge deer herd, so it is by no means certain that the population would decline. For the foreseeable future, snow goose and waterfowl hunting, especially the former, could increase, not because of habitat changes but because of increased management emphasis and support, especially on controlling snow goose numbers. However, increasing the take of snow geese has proven much more difficult in practice than simply increasing the number of hunting hours and changing hunting techniques.

Phasing out approximately 75% of the current refuge cropland acreage would cut by three-quarters the estimated gross annual receipts of $206,000 earned by eight cooperative farmers. However, this reduction would take place primarily by means of voluntary attrition and would be drawn out over a 15-year period, which should minimize most potential economic hardship. Furthermore, participating farmers have known for years that their leases are short-term and that croplands are being retired. This reduction has now been underway for more than a decade and has already retired more than 1,000 acres of cropland from DeSoto.

DeSoto Lake would continue to be managed much as it has, but with greater emphasis on enhancing water quality and aquatic habitat and especially, investigating the feasibility of various means of controlling lake water level. The inability to prevent excessive water levels during the summer, the most active season for lake-based recreation, has seriously interfered with fishing, boating, and even hiking adjacent trails. While Alternative D would not reconnect DeSoto Lake to the Missouri River (as would Alternative B), it would call for the completion of a preliminary study investigating the feasibility, implications, impacts (both beneficial and adverse) of the reconnection option.

A more concerted effort than under current management would be made to encourage cottonwood regeneration in DeSoto woodlands by means of a combination of planting and

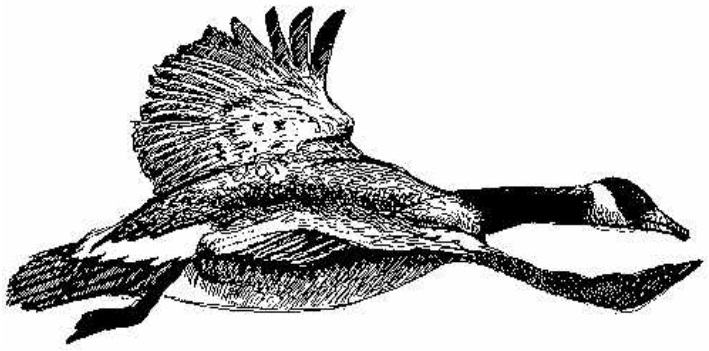
controlled flooding and pumping to encourage seed germination. If successful, these efforts would maintain a species which benefits wildlife by providing perches and nesting cavities.

Other refuge programs would not vary significantly from those envisioned under Alternative A (current management), but would be stepped up, improved, or augmented. The successful implementation of these programs, projects and initiatives is predicated on receiving the requisite funding.

It is difficult to predict the effects of Alternative D on sport hunting and fishing opportunities. While these two activities would continue to be encouraged, and disabled and youth hunts may be made available, habitat changes (i.e. less grain-producing cropland) could lead to a smaller deer herd. If lake renewal and fishery management efforts succeed, there could more anglers and larger creels. Opportunities for other uses — hiking, observation, and education — would increase.

In sum, this alternative addresses all issues raised in scoping. It acknowledges that certain concerns are in fact opposing or competing, and thus require a balancing of interests and values. It will increase forest and grassland acreage, attempt to rejuvenate declining cottonwoods, aggressively manage DeSoto Lake, and address snow geese overpopulation. It will also seek to improve protection of refuge resources and interact more effectively with stakeholders and partners. Refuge staff believe this alternative is the most realistic, feasible, and responsive to the list of issues and concerns facing DeSoto, and for that reason they selected it as the Preferred Alternative.

The matrix on the following pages compares the approach and/or outcome of each of the four alternatives to 30 issues, concerns and opportunities at DeSoto National Wildlife Refuge.



DeSoto National Wildlife Refuge

Comprehensive Conservation Plan / Environmental Assessment
Alternatives Matrix — Page 1
Summary of Actions and Effects of Management Alternatives

ISSUES/ CONCERNS /OPPOR-TUNITIES --	Alternative A - No Action (Current Mmgt.)	Alternative B - Historical Habitat Restoration	Alternative C - Maximize Public Use Potentials	Alternative D - Optimize Resources and Public Use
HABITAT MANAGEMENT				
Croplands	Gradual reduction from 2000 to 1000 acres	Eliminated altogether; reduced to zero acres	Maintain present acreage and plant small food plots to maximize public viewing	Gradual reduction from 2000 to 475 acres
Woodlands	Continual decline of mature bottomland forest (cottonwoods) in spite of opportun-istic efforts at regenertion	Significant increase in bottomland forests and cottonwoods	Continual decline of mature bottomland forest (cottonwoods) in spite of opportun-istic efforts at regen-eration	Active regeneration of bottomland forests, including cotton-woods; increase opportunistic efforts
Wetlands	Modest increase in acreage (up to 15 acres); additional wetland restoration off-refuge	Likely significant in-crease in permanent and ephemeral wet-lands (natural wet-lands)	Modest increase in-increase in acreage on refuge and private lands off-refuge present	Modest increase in managed wetlands from 101 acres at to 115 acres
Grasslands	Proportional increase of appox. 680 acres to about 2320 acres with gradual reduction in cropland; ongoing renovation and main-tenance to prevent encroachment by woody vegetation	Significant increase in wet prairie (e.g. prairie cordgrass)	Maintain grasslands at current level of about 1640 acres	Gradual increase in grassland acreage from 1640 acres at present to 2780 acres by 2015

DeSoto National Wildlife Refuge

Comprehensive Conservation Plan / Environmental Assessment
Alternatives Matrix — Page 2
Summary of Actions and Effects of Management Alternatives

ISSUES/ CONCERNS /OPPOR-TUNITIES --	Alternative A - No Action (Current Mmgt.)	Alternative B - Historical Habitat Restoration	Alternative C - Maximize Public Use Potentials	Alternative D - Optimize Resources and Public Use
HABITAT MANAGEMENT				
Lake Management	Limited ability to regulate water levels during wet cycles; maintain a stabilized man-made oxbow lake	Allow normal, natural successional processes to occur, likely leading to eventual loss of DeSoto Lake; feasibility study needed	High ability to manage lake level during both wet and dry cycles; extend public use season; increase artificial structures; increased bank stabilization	Same as Alt. C, but not necessarily extend public use season; feasibility study needed
Riverine	Ongoing monitoring	Increase in floodplain and riverine aquatic habitat; initiate feasibility studies for increasing riverine habitat	Ongoing monitoring	Accelerate riverine habitat restoration, thereby increasing compatible boating and fishing opportunities; feasibility study for installing water control structure on Wilson Island chute and re-routing agricultural drainage ditches
Research Natural Area	No active management	No active management	No active management	No active management

DeSoto National Wildlife Refuge

Comprehensive Conservation Plan / Environmental Assessment
Alternatives Matrix — Page 3
Summary of Actions and Effects of Management Alternatives

ISSUES/ CONCERNS /OPPOR-TUNITIES --	Alternative A - No Action (Current Mmgt.)	Alternative B - Historical Habitat Restoration	Alternative C - Maximize Public Use Potentials	Alternative D - Optimize Resources and Public Use
FISH AND WILDLIFE POPULATIONS MANAGEMENT				
DeSoto Lake Fisheries	Continue stocking native game fish; monitor fish populations; permit commercial rough fish harvest; a continued decline of quality sport fishing can be anticipated due to invasion of undesirable species, and lack of funds for adequate controls	Fishing would change from an intensively managed lake sport fishery to an opportunistic riverine fishery; long-term population monitoring	Renovate lake every 10 years & intensively restock with native sport fish; upgrade aeration and fish barriers; increase population monitoring/ inventory; more restrictive size and limit on sport harvest; increase law enforcement	Less frequent renovation than in Alt. C; otherwise, similar to Alt. C: restock intensively with native sport fish; permit commercial harvest as necessary; upgrade aeration & fish barriers; increase population monitoring; more restrictive size and limit on sport harvest; increase law enforcement
Resident Wildlife	Continue management practices to support populations; potential reduction of on-refuge use of cropland-dependent wildlife as they move off-refuge; decrease in local turkey, pheasant, and quail numbers because of reduced farmland	Decrease in resident wildlife of many species due to termination of intensive management; some species, however, will increase, such as grassland and woodland birds; decrease in turkey, pheasant, and quail numbers; long-term population monitoring	Emphasize land management to support wildlife; attract wildlife to increase public viewing opportunities; population numbers remain at status quo; hunting programs continue or increase; conduct feasibility study into building viewing platform off Hwy. 30	Native grassland and woodland species of birds and other vertebrates will benefit with the addition of more acreage of these habitats as croplands are reverted; may be decline in refuge game populations (deer, turkey, quail and pheasant) that depend more on croplands

DeSoto National Wildlife Refuge

Comprehensive Conservation Plan / Environmental Assessment
Alternatives Matrix — Page 4
Summary of Actions and Effects of Management Alternatives

ISSUES/ CONCERNS /OPPOR-TUNITIES --	Alternative A - No Action (Current Mmgt.)	Alternative B - Historical Habitat Restoration	Alternative C - Maximize Public Use Potentials	Alternative D - Optimize Resources and Public Use
FISH AND WILDLIFE POPULATIONS MANAGEMENT				
Migratory Wildlife	No change from current population numbers due to refuge actions; increase in neotropical migrant utilization, in particular, increased nesting opportunities in grassland areas	Gradual loss of snow goose population; wood ducks may increase; temporary improvement for waterfowl with increasing wetlands, then decline as wetlands gradually fill in; probable increase in numbers and diversity of neotropical migrants over time; increase of fish-eating birds; long-term population monitoring	Same as Alt. A: no change from current population numbers; neotropical birds stable at current levels or increase; conduct feasibility study into building viewing platform off Hwy. 30 for increased viewing	Neotropical birds benefit as a result of increased breeding habitat (forests and grasslands) over the present and over Alts. A & C. Fewer snow geese from more hunting and other control efforts; other waterfowl will increase, as will wading birds
Threatened and Endangered Species	Status quo in management, but ongoing ecological succession and processes continue: historic eagle roost may be lost as cottonwoods thin and die	Increased potential for pallid sturgeon; increased potential habitat for piping plover and least tern; lose bald eagles as lake silts in but roost sites may increase with cottonwoods; long-term monitoring	Likely increased disturbance of eagle roosts with increased public use; theatened trumpeter swans may be disturbed	Similar to Alt. A in many respects, but more aggressive effort to regenerate cottonwoods may positively impact future bald eagle use, expected to decline in Alt. A as cottonwoods dwindle
Snow Geese	Follow recommendations of Mid-continent Snow Goose Management Team; step up hunting in interim	Reduced attractiveness to snow geese by eliminating cropland and eventual elimination of oxbox lake; monitoring	Same as Alt. A: follow recommendations of Mid-continent Snow Goose Management Team; step up hunting	Same as Alt. A: follow recommendations of Mid-cont. Snow Goose Management Team; step up hunting

DeSoto National Wildlife Refuge

Comprehensive Conservation Plan / Environmental Assessment
Alternatives Matrix — Page 5
Summary of Actions and Effects of Management Alternatives

ISSUES/ CONCERNS /OPPOR-TUNITIES --	Alternative A - No Action (Current Mmgt.)	Alternative B - Historical Habitat Restoration	Alternative C - Maximize Public Use Potentials	Alternative D - Optimize Resources and Public Use
RESOURCE PROTECTION				
Bertrand Collection	Continue to support minimum requirements of *Bertrand* artifacts; comply with Scope of Collections Statement and Comprehensive Collection management Plan; continue monitoring, research and object loans	May jeopardize building (Visitor Center) by flooding; need to assure collection preservation, but consider other locations for storage of bulk of collection; retain core collection for interpretation purposes	Increase outreach, traveling exhibits and interpretation; more support to research and publication, educational materials, etc. expand interpretive themes to emphasize role of steamboats in Westward expansion & subsequent impacts	Similar to Alt. C: periodic refurbishing of exhibits; expand interpretive themes; greater outreach and traveling exhibits
Facilities/ Infrastructure	Ongoing decline of facilities with temporary closure of certain facilities likely; appropriate facilities protection constrained by 97% of budget going to fixed costs	Probable closure of public use facilities (Visitor Center, roads, trails) due to flooding and sedimentation; investigate facilities relocation options	Increase public use potential; upgrade and add to public use facilities, e.g. photo blind, viewing platform off Hwy. 30, roads, trails, exhibits	Similar to Alt. C but emphasis will complement natural resource protection even more; funding increased to meet 80/20% budgetary goals

DeSoto National Wildlife Refuge

Comprehensive Conservation Plan / Environmental Assessment
Alternatives Matrix — Page 6
Summary of Actions and Effects of Management Alternatives

ISSUES/ CONCERNS /OPPOR-TUNITIES --	Alternative A - No Action (Current Mmgt.)	Alternative B - Historical Habitat Restoration	Alternative C - Maximize Public Use Potentials	Alternative D - Optimize Resources and Public Use
RESOURCE PROTECTION				
Invasive/ Exotic Species	Continue monitoring; some mechanical, chemical, biological, controls; continue commercial fishing; undesirable organisms include phragmites, musk thistle, purple loose-strife, gizzard shad, Chinese elm; overall, undesirable species likely to continue to increase or become dominant in spite of present efforts	Full-scale assault on all invasive and exotic species in pur-suit of pre-develop-ment floral and faunal communities	Intensive management of selected species in publicly visible areas; intensify actions to control non-indigenous aquatic species; over-all, less emphasis on exotic control, espec-ially among lesser-known, inconspicuous species	More aggressive efforts than at present to control non-natives
Law Enforcement (fish & wildlife as is protection)	Continue efforts; maintain program	Decrease efforts as public use declines	Increase full-time law enforcement effort	Potential modest increase in law enforcement effort

DeSoto National Wildlife Refuge

Comprehensive Conservation Plan / Environmental Assessment
Alternatives Matrix — Page 7
Summary of Actions and Effects of Management Alternatives

ISSUES/ CONCERNS /OPPOR-TUNITIES --	Alternative A - No Action (Current Mmgt.)	Alternative B - Historical Habitat Restoration	Alternative C - Maximize Public Use Potentials	Alternative D - Optimize Resources and Public Use
PUBLIC EDUCATION AND RECREATION				
Environmental Education	Passive education effort; school groups use DeSoto; public school teachers conduct most actual education	Passive education would continue, but with a different theme, that of ecological restoration and natural succession	Increase staff and more active education effort; education would be conducted on-site as well as off-site in an intensified program of outreach	More emphasis on environmental education than in Alt. A, but less than Alt. C.
Interpretation	Relatively non-personal — consists of interpreted fall auto tour route, nature trails, & Visitor Center exhibits; demand deficit continues	Relatively non-personal — consists of nature trails and exhibits at the Visitor Center	A more staff-conducted interpretive program would be undertaken, including more trails, exhibits, and programs	A more staff-conducted interpretive program would be undertaken, including more trails, exhibits, and programs
Hunting	Hunting would not be expanded from present levels, which include 3 deer hunts (1 muzzleloader & 2 archery) with a take of about 100/year, and 1 guided snow goose hunt	Deer hunting would probably decline; snow goose hunting would definitely decline; possible increase in other waterfowl hunting opportunities at least in near-term future	Shotgun, disabled & youth hunts would be added & bow hunts increased; snow goose hunt would continue or increase; turkey & pheasant would be added; increase accessible acreage	In general, same as Alt. A.; possible increases in some hunts (disabled and youth), although reduction in cropland acreage may reduce numbers of some game animals

DeSoto National Wildlife Refuge

Comprehensive Conservation Plan / Environmental Assessment
Alternatives Matrix — Page 8
Summary of Actions and Effects of Management Alternatives

ISSUES/ CONCERNS /OPPOR-TUNITIES --	Alternative A - No Action (Current Mmgt.)	Alternative B - Historical Habitat Restoration	Alternative C - Maximize Public Use Potentials	Alternative D - Optimize Resources and Public Use
PUBLIC EDUCATION AND RECREATION				
Fishing	Continual slow decline in desirable sport fish; overall level of fishing continues to decline; possible future lake renovation could improve fishing	Sport fishing would decline and eventually disappear altogether as the lake silted in; composition of catch would shift to riverine species in near to medium term	Aggressive efforts on part of refuge leading to increased level of fishing and higher quality experience; greater harvests; lake renovation	The level of effort to restore a higher-quality sport fishery would be between Alt. A and Alt. C
Photography	Existing low level of dedicated photography would continue	Existing low level of dedicated photography would continue	Add blinds to accommodate more photography; encourage photographers by holding more workshops	Accommodate a modest level of special photography permits; hold workshops; level of effort between Alt. A and Alt. C
Wildlife Observation	Very high level seasonally at Visitor Cen- and around refuge, especially Bob Starr Observation Deck	Highly likely to decline due to less accessibility; changing habitat will attract fewer snow geese and visitors	Install viewing deck on Hwy. 30; expand auto tour length and dates; more roadside turnouts	Conduct feasibility study on Hwy. 30 deck, examining traffic & safety issues; tour dates, signs & turnouts expanded

DeSoto National Wildlife Refuge

Comprehensive Conservation Plan / Environmental Assessment
Alternatives Matrix — Page 9
Summary of Actions and Effects of Management Alternatives

ISSUES/ CONCERNS /OPPOR-TUNITIES --	Alternative A - No Action (Current Mmgt.)	Alternative B - Historical Habitat Restoration	Alternative C - Maximize Public Use Potentials	Alternative D - Optimize Resources and Public Use
PUBLIC EDUCATION AND RECREATION				
Outreach	Media outreach (about 40 news releases per year); about a dozen off-refuge talks a year; occasional broadcasts	A different message would need to be crafted to explain refuge changes to a perhaps skeptical public	Outreach programs to schools, civic groups, and the community would be vastly expanded	Level of effort would be greater than Alt. A and less than Alt. C
Other Compatible or Established Uses	Mushroom and berry picking permitted in limited areas	Access would decline; use may also be discouraged to maximize habitat values	Allow existing uses & open more areas; consider State campground at South Gate; build bicycle lanes	Consider accommodating any activity compatible with mission; allow but control existing uses

DeSoto National Wildlife Refuge

Comprehensive Conservation Plan / Environmental Assessment
Alternatives Matrix — Page 10
Summary of Actions and Effects of Management Alternatives

ISSUES/ CONCERNS /OPPOR-TUNITIES --	Alternative A - No Action (Current Mmgt.)	Alternative B - Historical Habitat Restoration	Alternative C - Maximize Public Use Potentials	Alternative D - Optimize Resources and Public Use
PARTNERSHIPS				
Individual Volunteers	Medium level of volunteer support	Use more volunteers to enhance and maintain habitats	Increase effort to actively recruit and train volunteers (e.g. volunteer coordinator position)	Increase level of volunteer hours to enhance and maintain habitat; actively recruit and train volunteers through a volunteer coordinator position
Research	Continue existing cooperative agreements with universities for biological research; cooperate with research organizations when approached with viable projects; staff conduct research on their own intiative (e.g. wildlife utilization of cropland and other habitats); ongoing *Bertrand* Collection research, on/ off refuge	Continue all of efforts in Alt. A; in addition, monitor and research effects of habitat changes as they occur; conduct long-term studies to document changes and impacts; DeSoto could be promoted as a "natural laboratory"	Same as Alt. A; in addition, increase *Bertrand* Collection research as well as research into public use impacts on refuge habitat and wildlife	Would be a combination of Alt. A, Alt. B and Alt. C; in addition, the refuge would actively recruit researchers for targeted projects

DeSoto National Wildlife Refuge

Comprehensive Conservation Plan / Environmental Assessment
Alternatives Matrix — Page 11
Summary of Actions and Effects of Management Alternatives

ISSUES/ CONCERNS /OPPOR-TUNITIES --	Alternative A - No Action (Current Mmgt.)	Alternative B - Historical Habitat Restoration	Alternative C - Maximize Public Use Potentials	Alternative D - Optimize Resources and Public Use
PARTNERSHIPS				
Private Lands Program	Maintain program at existing level, producing a modest increase in wetland and upland habitat on private land, through cost share initiatives; program administers areas in 18 counties in western Iowa; cost share with Ducks Unlimited, Pheasants Forever, Iowa DNR, NRCS, and County Conservation Boards	Continue with program in Alt. A; in addition, monitor and increase funding base for developing new agreements and monitoring	Combination of Alts. A & B as well as provide public forums to maximize public knowledge and participation in private lands program	Combination of Alts. A & B: maintain existing private lands programs and partnerships and increase funding base for developing new agreements and monitoring
NGO's (Non-Governmental Organizations)	Partnership with Midwest Interpretive Association continues; partner with Omaha Chapter of the Audubon Society; informal cooperative efforts with Boy & Girl Scouts and other groups; Ducks Unlimited matching funds	Same as Alt. A: partnership with MIA continues; partner with Omaha Chapter of the Audubon Society; informal cooperative efforts with Boy & Girl Scouts and other groups; D.U. matching funds	An enhanced version of Alt. A; continue all existing partnerships and actively seek others; encourage formation of "Friends of DeSoto" or similar group; more DeSoto & *Bertrand*-themed materials for sale in Visitor Center	An enhanced version of Alt. A; continue all existing partnerships and actively seek others; encourage formation of "Friends of DeSoto" or similar group; more DeSoto & *Bertrand*-themed materials for sale in Visitor Center

DeSoto National Wildlife Refuge

Comprehensive Conservation Plan / Environmental Assessment
Alternatives Matrix — Page 12
Summary of Actions and Effects of Management Alternatives

ISSUES/ CONCERNS /OPPOR-TUNITIES --	Alternative A - No Action (Current Mmgt.)	Alternative B - Historical Habitat Restoration	Alternative C - Maximize Public Use Potentials	Alternative D - Optimize Resources and Public Use
PARTNERSHIPS				
Government Agencies (Federal State, Tribal)	Continue all existing partnerships, includ-ing new cooperation with NRCS	Continue all existing partnerships, includ-ing new cooperation with NRCS	Increase partnering; work with IA DNR on providing improved camping facilities; more cooperation with NE Historical Society	Combination of Alts. A & C; however, consider feasibility study of camping on south end of refuge

Chapter 5
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Chapter 6
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Chapter 7
References

See Appendix G.